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EVALUATION OF C-130 AIRCRAFT MODULAR AERIAL SPRAY SYSTEM (MASS) FOR HIGH VOLUME (HV) APPLICATION OF HERBICIDES - FUSELAGE BOOMS (TRIALS HV-1 AND HV-2)

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ABSTRACT

This paper discusses methods and results of a cooperative test with the U.S. Air Force to evaluate the C-130 MASS high volume aerial spray system with fuselage booms. Six trials were conducted late morning of December 14, 1988 at Avon Park Air Force Range using a C-130E aircraft. Results based upon analysis of the spray deposition samplers demonstrate that the MASS high volume fuselage configuration meets the specifications of the system delivering a 500 micrometer drop size.

INTRODUCTION

Field tests of the C-130E aircraft were conducted by the U.S. Air Force (USAF) in cooperation with U.S. Department of Agriculture Forest Service (FS) at Avon Park Air Force Range on December 14, 1988. The objective of the aerial spray C-130 MASS system test was to determine if the MASS system's high volume (HV) application fuselage spray boom met the HV specifications of applying 30 gallons per acre of 500 micrometer or larger diameter drops dispersed in swath widths of 100 to 200 feet and in crosswinds 3 to 8 knots at altitudes not exceeding 500 feet AGL. This report addresses the drop size and swath width aspects of the specifications.

METHOD

Six trials were conducted consisting of - three trials, fuselage boom, crosswind and three trials, fuselage boom, inwind. In each trial, except Trial HV1-3, the C-130E flew 100 feet above a 1,000 foot long line of Kromekote card samplers positioned on the ground to collect spray drops. In Trial HV1-3 the release height was 150 feet above the cards. The water-base spray with Staput was dyed with FD&C No. 40 red dye, making the red drop stains visible on the white Kromekote cards. A test matrix for the trials is provided in Table 1.

The data and analyses presented in this report are based upon hand counting and sizing of spray drops on Kromekote sampling cards. The resulting counts were then processed through the Automatic Spot Counting and Sizing (ASCAS) data program (Young et al 1977). The ASCAS output provides data on

drop size diameter (volume mean, volume median, number mean, and number median); drop density; and volume density.

The USAF specifications did not state an acceptable drop or volume deposition within the 100 to 200 foot spray swath performance specification.

Meteorological measurements from the field test are provided in Table 2.

RESULTS

Results of the field trials demonstrate that the C-130E, MASS high volume spray, fuselage boom system meets the drop size specification for drop size of 500 micrometers or larger. The volume median diameter ranged from 596 to 2192 micrometers (Table 3).

Mean drop deposition and swath width appear to be reasonably consistent within the replicates with exception of the HV1-3 trial. On HV1-3 stain drop size was smaller and mean drop density smaller. This may have been a result of the C-130E flying 150 feet above the card line in lieu of the prescribed 100 feet above the card line.

The data shown in Table 4 illustrates the relationship of drop size to the amount of spray depositing on the ground - especially as measured in spray volume. For most herbicide applications the spray should consist of drops above 500 micrometers. This size has a greater chance of depositing on target and not drifting. Table 4 provides estimates of deposition in gallons per acre (GPA) as a function of drop size (VMD) and numbers of drops observed on deposit cards (drops/CM^2).

CONCLUSION

These results demonstrate that the MASS system as configured for these trials meets specifications.

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Table 1
High Volume (HV) Fuselage Boom Trial Matrix

Test Number	HV1 (Crosswind)	HV2 (Inwind)
Replication	1-3	1-3
Trial Number	30-32	33-35
Flow Rate (g/m)	800	800
Formulation	Water Dyed w/FD&C 40 + Staput	Water Dyed w/FD&C 40 + Staput
AGL (Ft.)	100*	100
Ground Speed (KTS)	180	180
Boom Configuration	Fuselage, 3-Inch Diameter Pipe	Fuselage, 3-Inch Diameter Pipe

*Note: Release height for Trial HV1-3 was 150 feet.

Table 2
Meteorological Data Measured at Spray Site

Trial	Time Trial	Wind Speed (KTS)	Wind Direction (Degrees)	Cloud Cover	Relative Humidity (%)	Temperature (Deg. F)
HV1-1	1018	6-7	020	Clear	56*	54
HV1-2	1045	2-3	030	Clear	61**	56
HV1-3	1102	3-4	040	Clear	55**	59
HV2-1	1144	5-6	060	Clear	52***	62
HV2-2	1202	5-6	060	Clear	52***	62
HV2-3	1230	4-6	060	Clear	52***	62

* At 1000
** At 1100
*** At 1200

Table 3 - Results of High Volume (HV) Fuselage Boom Applications and Observed Swath Widths

Test Series/ Replication (1)	VMD/ Drop Size (2)	Mean Drop (Drops Per Sq. CM)	Range Drop Density (Drops Per Sq. CM)	Swath Width
HV1-1 Crosswind	2192	15	2-72	120
HV1-2 Crosswind	1087	12	1-84	150
HV1-3 Crosswind	596	5	1-22	370
HV2-1 Inwind	1270	11	2-52	330
HV2-2 Inwind	1051	9	1-32	320
HV2-3 Inwind	1203	11	1-57	260

(1) HV2 trials were planned as Inwind tests, however, crosswind occurred during each HV2 test. See Table 2.

(2) The volume median diameter (VMD) is the drop size that represents 50% of the volume. Half the volume is in drops below the VMD and half is in drops above the VMD.

Table 4

Range of Estimated Volume (gallons per acre) Deposition Along Swath Width as Function of Drop Size (VMD) and Mean Drop Density

Test Series/ Replication	VMD	Mean Drop Density (Drops/CM2)	Mean Estimate Volume (GPA)	Swath Width
HV1-1	2192	15	38	120
HV1-2	1087	12	6	150
HV1-3	596	5	.53	370
HV2-1	1270	11	4	330
HV2-2	1051	9	7	320
HV2-3	1203	11	7	260